

Exhibit O

O F I C E

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**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

DEC 29 2010

Federal Communications Commission
Office of the Secretary

In the Matter of

)

Amendment of Section 73.622(b)
Digital Television Table of Allotments
Jackson, Mississippi

)

MB Docket No. _____
RM _____

To: Office of the Secretary
(Attention: Chief, Video Division, Media Bureau)

Supplement to Petition for Rulemaking

George S. Flinn, Jr. (hereinafter "Flinn"), licensee of WWJX-DT, Jackson, Mississippi (Facility ID 166512), by his attorney, hereby respectfully submits a Supplement to his "Petition for Rulemaking" filed on August 6, 2010. As may be noted in the Petition for Rulemaking, it has been requested that the Commission amend the DTV Table of Allotments by substituting Channel 23 for Channel 51 for use by WWJX - DT at Jackson, Mississippi.

The subject Supplement (attached hereto) is submitted in response to an informal staff request and consists of further information in support of the public interest showing made by Flinn in connection with the proposal. Specifically, the Supplement consists of an engineering analysis detailing the interference issues which Cellular South expects to experience on its LTE Cellular Base Stations (on Channel 52) from the operation of WWJX (on Channel 51).

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Respectfully submitted,

George S. Flinn, Jr.

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December 29, 2010

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**Analysis of Interference to LTE Cellular Base Stations
From Adjacent Channel Digital Television System WWJX, Jackson, MS**

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Analysis of Interference to LTE Cellular Base Stations From Adjacent Channel Digital Television System WWJX, Jackson, MS

Introduction

This investigation considers the LTE system adjacent to Channel 51 facility WWJX, Jackson, MS. LTE base stations receive in the Lower A Block. This block is directly adjacent to and above DTV systems on Channel 51. Various methods of interference are discussed and an analysis performed to determine the likelihood of interference to the Lower A Block LTE system from WWJX.

Executive Summary

An investigation into the possibility of interference from WWJX into the upper adjacent channel LTE system determined that two classic types of interference are likely.

The first is out of band emission power (OOBE) emanating from the adjacent Channel TV transmission facilities. Interference of this type has been recognized by the FCC for decades and most recently addressed by the Media Bureau in cases where a new DTV station would be located adjacent to established Land Mobile (wireless) facilities. An example of the FCC process can be seen in the condition placed on the construction permit of CH 14 (470-476 MHz) DTV facility WMEI in Puerto Rico, file number BMPCDT-20080620ACV. The condition states in part "During equipment tests, authorized by Section 73.1610 of the Commission's Rules, the permittee shall take adequate measures to identify and substantially eliminate objectionable interference which may be caused to existing land mobile radio facilities in the 460 to 470 MHz band...".

The second is blocking interference or receiver desensitization (RD) caused by the high power DTV transmitter overloading LTE system receivers in the region around the transmitter site.

Of the two, the out of band energy (OOBE) from WWJX would significantly affect the LTE system. The interference will be so severe, over a very large area, that the successful deployment of the LTE system is unlikely. At this point in time, other than moving WWJX to another TV channel, no solution is apparent. The reason that the DTV to LTE interference is so severe is that the FCC did not condition DTV construction permits to provide protection to the adjacent 700 MHz wireless channels as it has historically been provided for licensed wireless facilities.

Methodology and Data

Much of the data and analysis within this document is obtained from an Alcatel-Lucent Proprietary document titled "Interference from DTV Ch 51 Station to Lower A Block LTE BS: Antenna Isolation Calculation Based on Criterion 1" and the FCC Rules regarding Digital Television out of band emissions.

Channel 51 is the six megahertz band from 692 to 698 MHz. The Lower A Block is the 6 MHz band from 698 to 704 MHz. The LTE (Long Term Evolution) equipment analyzed within this document will operate in the five MHz channel from 699 to 704 MHz. This leaves a 1 MHz "guard band" between DTV transmissions and the LTE base station receive equipment.

There are two normal methods of interference in which DTV might interfere with reception at the LTE base station:

- 1) the base station receiver might receive some of the main DTV signal causing desensitization of the LTE base station receiver; and
 - 2) the DTV out of band emissions (OOBE) may cause interference to base station reception.
- Both will be investigated.

According to the Alcatel-Lucent document, the base station out of band signal rejection allows a 0.4 db desensitization in the presence of an adjacent channel -10 dbm DTV carrier at the antenna connector of the base station receiver.¹ This is the LTE system criteria that would pertain to interference Method 1.

Method 2 corresponds to the out of band emissions created by the adjacent channel DTV facility. According to the Federal Communications Commission rules, CFR Title 47 Part 73.622 (h)(1)², the out of band emissions measured in 500 kHz band segments must be attenuated no less than 11.5($\Delta f + 3.6$) db at 0.5 to 6 MHz offsets from the DTV band edge.

The formula for the decrease in db of the out of band emissions (OOBE) of the DTV from the main DTV average power level is:

$$\text{DTVAP(dbm)} - \text{Out of band emission level(dbm)} = \text{Reduction (db) of the OOBE from the DTVAP}$$

or

$$\text{DTVAP(dbm)} - [\text{DTVAP(dbm)} - 11.5(\Delta f + 3.6)] = \text{Reduction (db) of the OOBE from the DTVAP}$$

Where:

DTVAP = Digital Television Average Power

OOBE = Out of Band Emissions

¹ Interference from DTV CH 51 Station to Lower A Block LTE BS: Antenna Isolation Calculation Based on Criterion 1, Alcatel-Lucent Proprietary, April 2010, provided by Raouf Al Bahraini

² 73.622(h)(1) The power level of emissions on frequencies outside the authorized channel of operation must be attenuated no less than the following amounts below the average transmitted power within the authorized channel. In the first 500 kHz from the channel edge the emissions must be attenuated no less than 47 dB. More than 6 MHz from the channel edge, emissions must be attenuated no less than 110 dB. At any frequency between 0.5 and 6 MHz from the channel edge, emissions must be attenuated no less than the value determined by the following formula: Attenuation in dB = -11.5($\Delta f + 3.6$); Where: Δf = frequency difference in MHz from the edge of the channel.

This reduces to:

$$-11.5(\Delta F + 3.6) = \text{Reduction (db) of the OOB from the DTVAP}$$

The amount of out of band power reduction in db is always the same regardless of DTV carrier power.

According to the Alcatel-Lucent document, the base station receive band falls into the effective LTE resource blocks 699.25-703.75 MHz.³ Using each 500 kHz block beginning at 699.25 MHz gives center frequencies shown in Table A. The table uses 1 mWatt (0 dbm) as a reference.

Table A

Center of 500 kHz Block (MHz)	ΔF (from Ch 51 Band Edge)	$-11(\Delta F + 3.6)$	Power (mWatts)
699.5	1.5	-58.65	1.36458E-06
700.0	2.0	-64.40	3.63078E-07
700.5	2.5	-70.15	9.66051E-08
701.0	3.0	-75.90	2.5704E-08
701.5	3.5	-81.65	6.83912E-09
702.0	4.0	-87.40	1.8197E-09
702.5	4.5	-93.15	4.84172E-10
703.0	5.0	-98.90	1.28825E-10
703.5	5.5	-104.65	3.42768E-11
		Total Power (mWatts)	1.85928E-06
		Total Power in db (Ref 1 mWatt)	-57.3065606

The total out of band emission level affecting the LTE signal will be -57.3 db below the DTV average power.⁴ Note that most of the OOB energy occurs during the first 500 kHz of the LTE band with very little added for the next 3.5 MHz. However, for the purposes of this investigation, we must

³ Interference from DTV CH 51 Station to Lower A Block LTE BS: Antenna Isolation Calculation Based on Criterion 1, Alcatel-Lucent Proprietary, April 2010, provided by Raouf Al Bahrani

⁴ Interference from DTV CH 51 Station to Lower A Block LTE BS: Antenna Isolation Calculation Based on Criterion 1, Alcatel-Lucent Proprietary, April 2010, provided by Raouf Al Bahrani

consider the total amount of DTV out of band energy falling within the operational band of the LTE system.

Examination of the Effects of Interference Method 1

The LTE system can survive an adjacent channel DTV signal at a signal level of -10 dbm. Assume a base station receive LTE system with an antenna height of 30 meters and an overall antenna gain of 8.85 dbd (11.0 dbi). WWJX, Jackson, MS transmits with an ERP (Effective Radiated Power) of 20 kW at an antenna height of 128 meters above ground with a directional antenna. Using these values and given the required value of -10 dbm at the LTE receiver as being the limit for adjacent channel power into the LTE receiver, a Longley-Rice model of interference occurring 10% of the time at 50% of the places shows an area of 3.5 Sq. Km. that would receive interference should an LTE base station with the assumed parameters be located within that area. Figure 1 demonstrates this area about the WWJX DTV transmitter.

Examination of the Effects of Interference Method 2

The LTE base station receiver has a noise floor of -104.5 dbm.⁵ In order to prevent virtually any desensitization in the LTE receive system, the requirement is that any external receive noise be received at the antenna input port with a level not to exceed -114.5 dbm. This level of interfering signal at 10 db below the thermal noise level of the receiver would add virtually no noise to the system. Therefore, it is necessary to determine the received level of the undesired OOB signal. That signal would have a level of -57.3 db lower than the 20 kW ERP level of the main WWJX signal. The ERP of this out of band emission signal would have the equivalent ERP of 37 mWatts. This signal would be radiated from the WWJX site. Based on this signal level and the assumed values of the LTE system, and the maximum allowed received signal level of -114.5 dbm required for no level of interference to the LTE system, the Longley-Rice model calculated an interference area of 5,484 Sq.Km. with a population of 435,638⁶. Any LTE base station within this area would be desensitized by the OOB from the WWJX DTV facility. While this appears to be a very large interference area for a ERP of 0.037 watts, the required protection is very stringent and the model predicts the interference level occurring only 10% of the time. Figure 2 demonstrates this interference area.

Figure 3 allows the observation of the difference in interference area between the out of band rejection capabilities of the LTE system and the in band sensitivity to the OOB produced by the DTV facility. The OOB is by far the greater threat. There is nothing that can be done by the LTE receiving system to eliminate this kind of interference. Much more stringent filters, if possible, would have to be installed by the DTV facility to help in this matter. Also, further filtering by the LTE system would be required to eliminate problems occurring from the main adjacent channel DTV facility. It is not known

⁵ Interference from DTV CH 51 Station to Lower A Block LTE BS: Antenna Isolation Calculation Based on Criterion 1, Alcatel-Lucent Proprietary, April 2010

⁶ 2000 Census

whether enough filtering could be accomplished in order to eliminate all possibilities for interference to the LTE system.

Figures 4 and 5 show the effects of interference to LTE base station coverage in two particular situations. Figure 4 demonstrates the Longley-Rice 90% time, 90% location uplink coverage of a base station 5 km due north of the WWJX DTV facility. Figure 5 demonstrates the Longley-Rice 90% time, 90% location uplink coverage of a base station 30 km due north of the WWJX DTV facility. Several assumptions are made⁷:

- Effective radiated power output of the subscriber cell phone is 600 mWatts.
- Effective radiated power output of the base station is 1,000,000 mWatts (1 kW).
- Base station receive antenna is 8.85 dbd allowing for coax loss.
- Base station receive antenna height is 30 meters above ground.
- Base station receive antenna is omni-directional, i.e. the receive antenna is not sectorized.
- The thermal noise of the base station receive is -104.5 dbm.
- The signal to noise plus interference ratio required for adequate reception of the subscriber units by the base station is 12 db.
- Coverage is calculated on a 90% time, 90% location basis.
- Interference is calculated on a 10% time, 50% location basis.
- Areas shown are areas in which the cell phone can talk back to the base station 90% of the time at 90% of the locations within that area.
- The interference level from the DTV facility is constant although the prediction is for interference rising to the level demonstrated for only 10% of the time.

Therefore the figures shown demonstrate the base station receive coverage at the times in which the DTV interference is actually occurring. This would be approximately 10% of the time. Figure 4 demonstrates the reduction in coverage at a particular base station located 5 km north of WWJX. The noise level experienced by the base station receivers at that distance is almost totally from the DTV OOB. That level was calculated from the Longley-Rice model to be -75.5 dbm at the antenna input to the base station receiver. Therefore, since a 12 db C/I+N (Carrier to Interference plus Noise) ratio is required for adequate reception, a received signal level from the subscriber units needs to be -63.5 dbm. The black area of 10.1 Sq. km demonstrates the coverage at this noise level. The population within this area is 424. -92.5 dbm is required for coverage without any interference given that the noise floor is -104.5 dbm. The blue area of 200.0 Sq. km demonstrates this interference free coverage. The population within this area is 8,019. The DTV interference causes a reduction in coverage of 94.9% of the area and 94.7% of the population.

Figure 5 demonstrates the loss of coverage of a base station located 30 km north of the DTV facility. At that distance the combined noise in the receiver from the thermal noise and the DTV

⁷ Data on the details of the Alcatel-Lucent base station receivers were not available; therefore, reasonable assumptions were made for the purposes of this analysis.

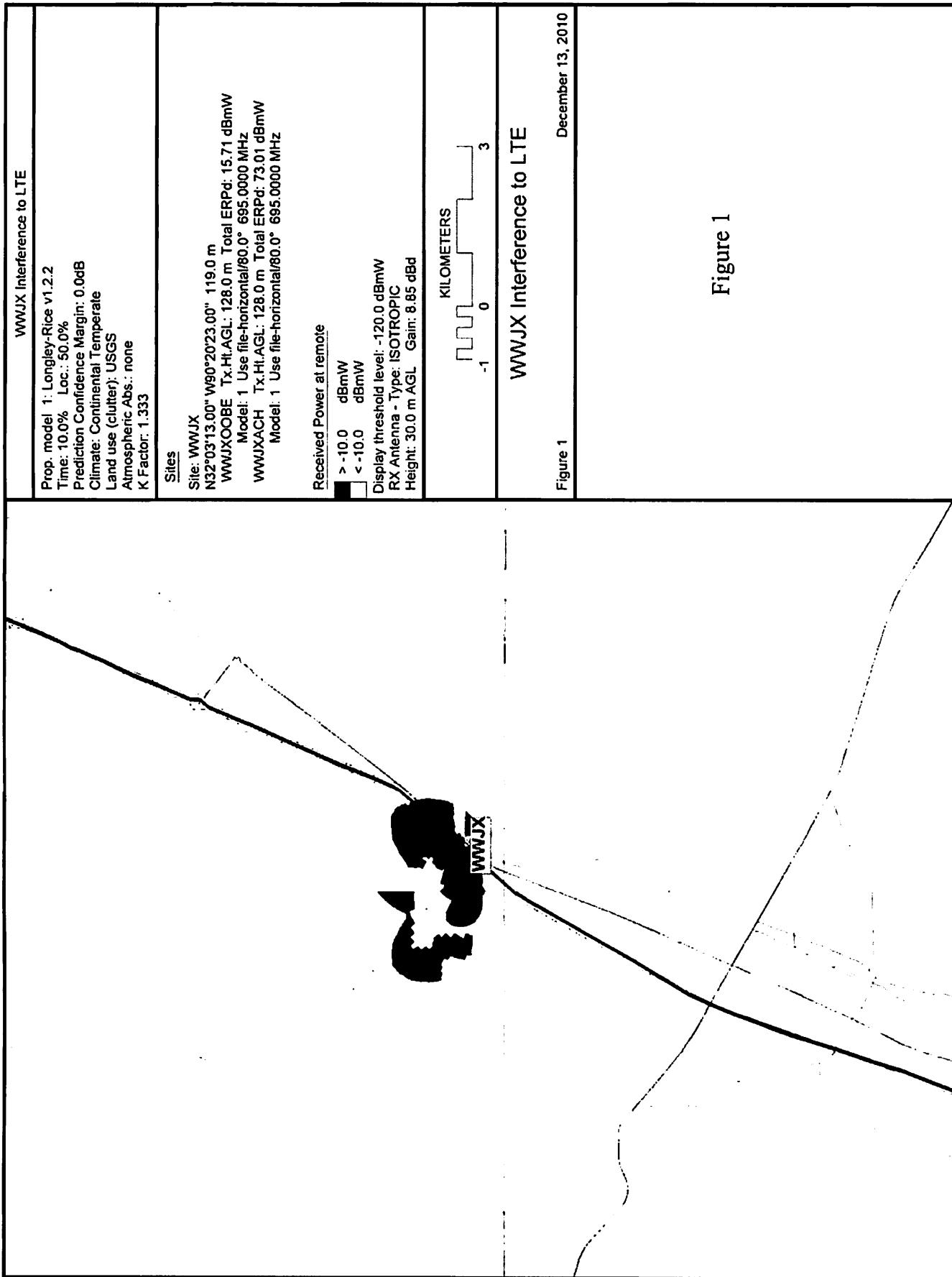
interference is -100.2 dbm. Based on a required signal level of -88.2 dbm with interference and -92.5 dbm without interference, the study gives an interference coverage area of 146.0 Sq. kM with a population of 20,142 and a non-interference coverage area of 255.7 Sq. kM with a population of 28,586. Therefore the area is reduced by 42.9% and the population by 29.5%.

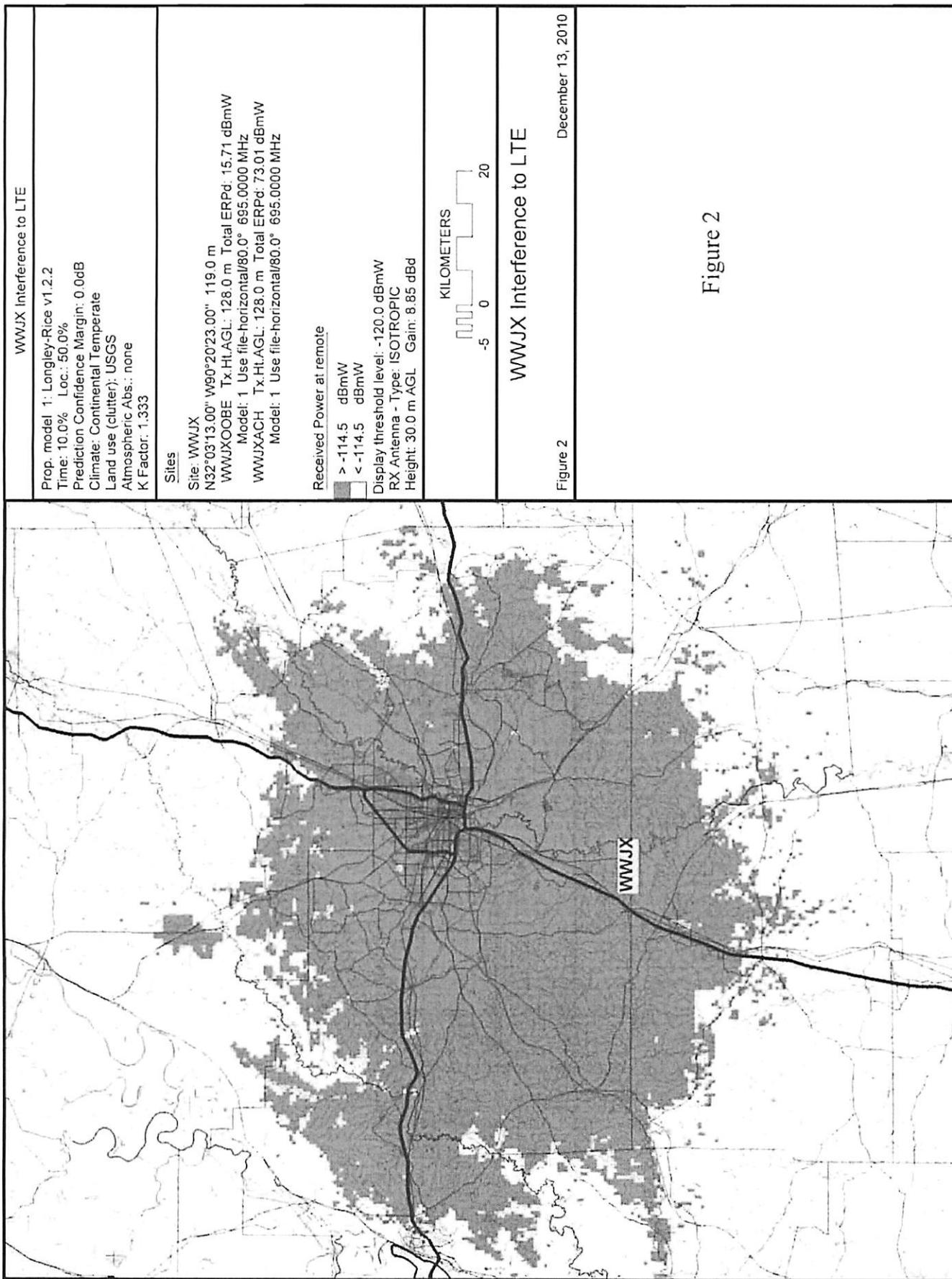
These two examples demonstrate that the effects of the interference are not constant but depend on the distance from the DTV facility. The farther the distance from the DTV, the less affected the base station reception. In any case, the LTE system is greatly affected by the WWJX facility.

Conclusion

Figures 4 and 5 represent the practical impact from WWJX to two Lower A Block LTE base stations located at different distances from the WWJX transmitter site. The near in site experiences interference to over 94% of the area and population that would be served if the WWJX facility did not exist on CH 51. The more distant site experiences interference to essentially 43% of the area and 29% of the population that would be served if the WWJX facility did not exist on CH 51. The full impact to the Lower A Block LTE system is dramatic given that the system will consist of many additional sites in multiple counties many of them experiencing extensive areas of interference from the CH 51 DTV facility.

Charles Ellis, PE
December 24, 2010





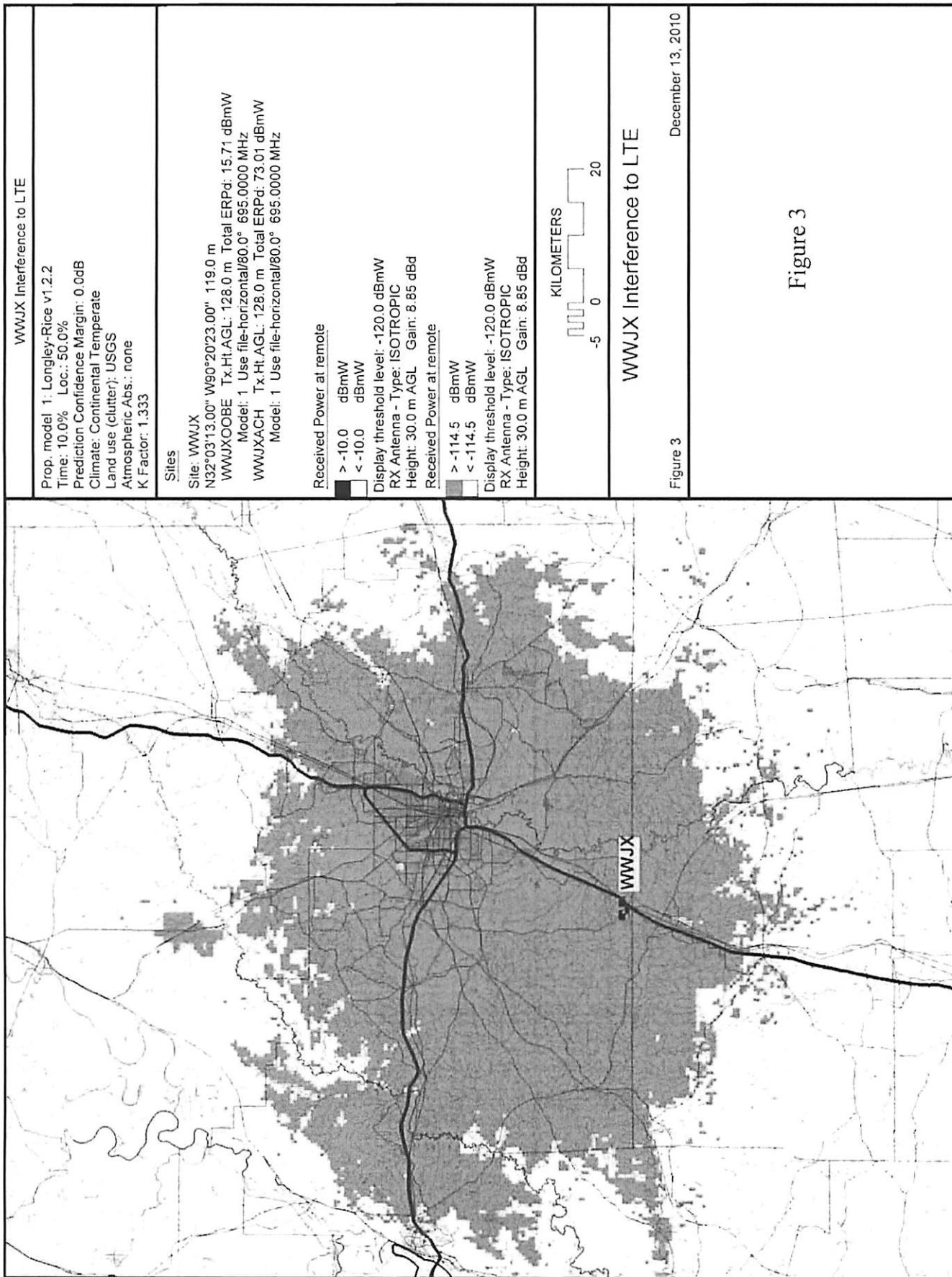
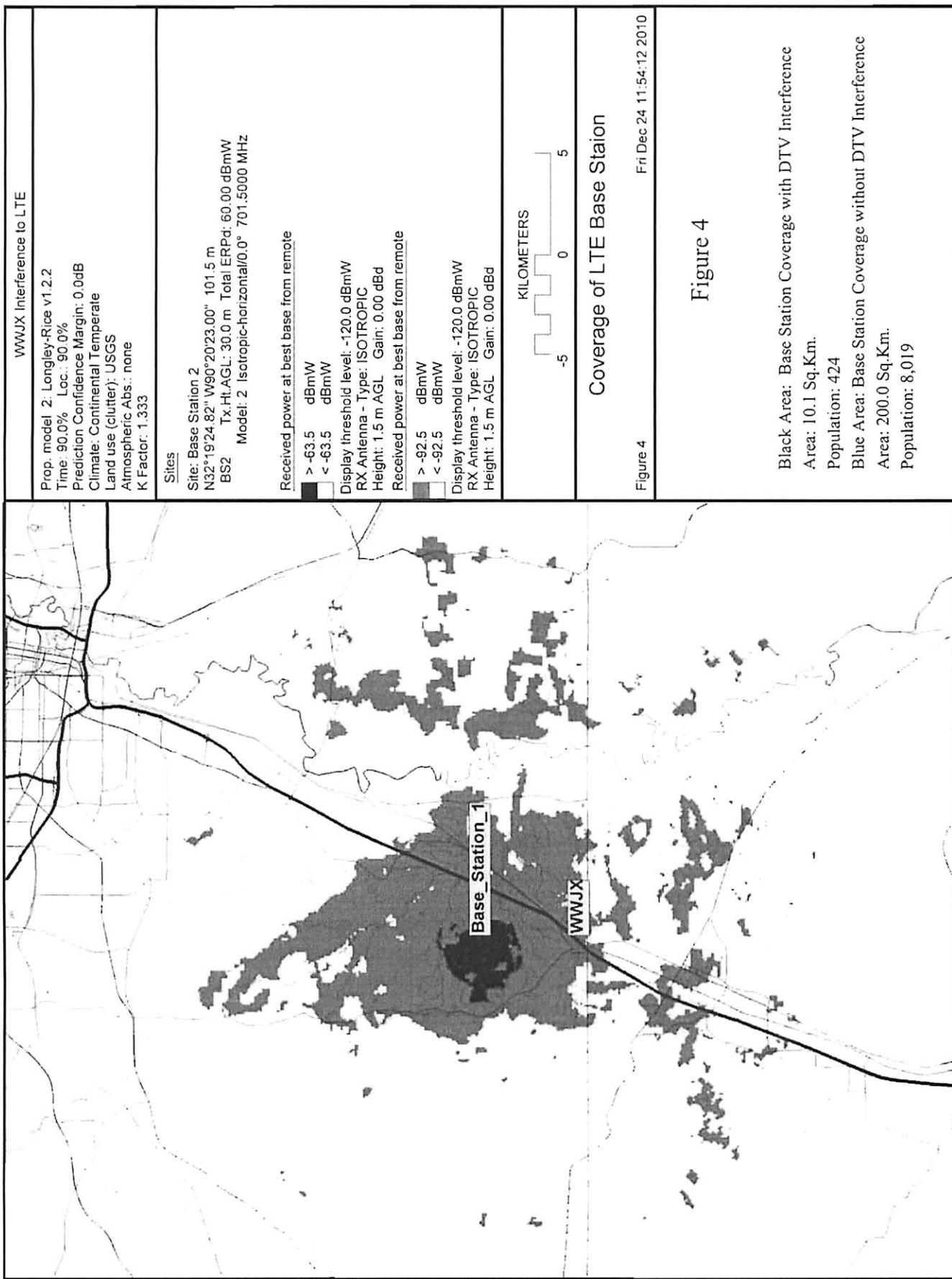
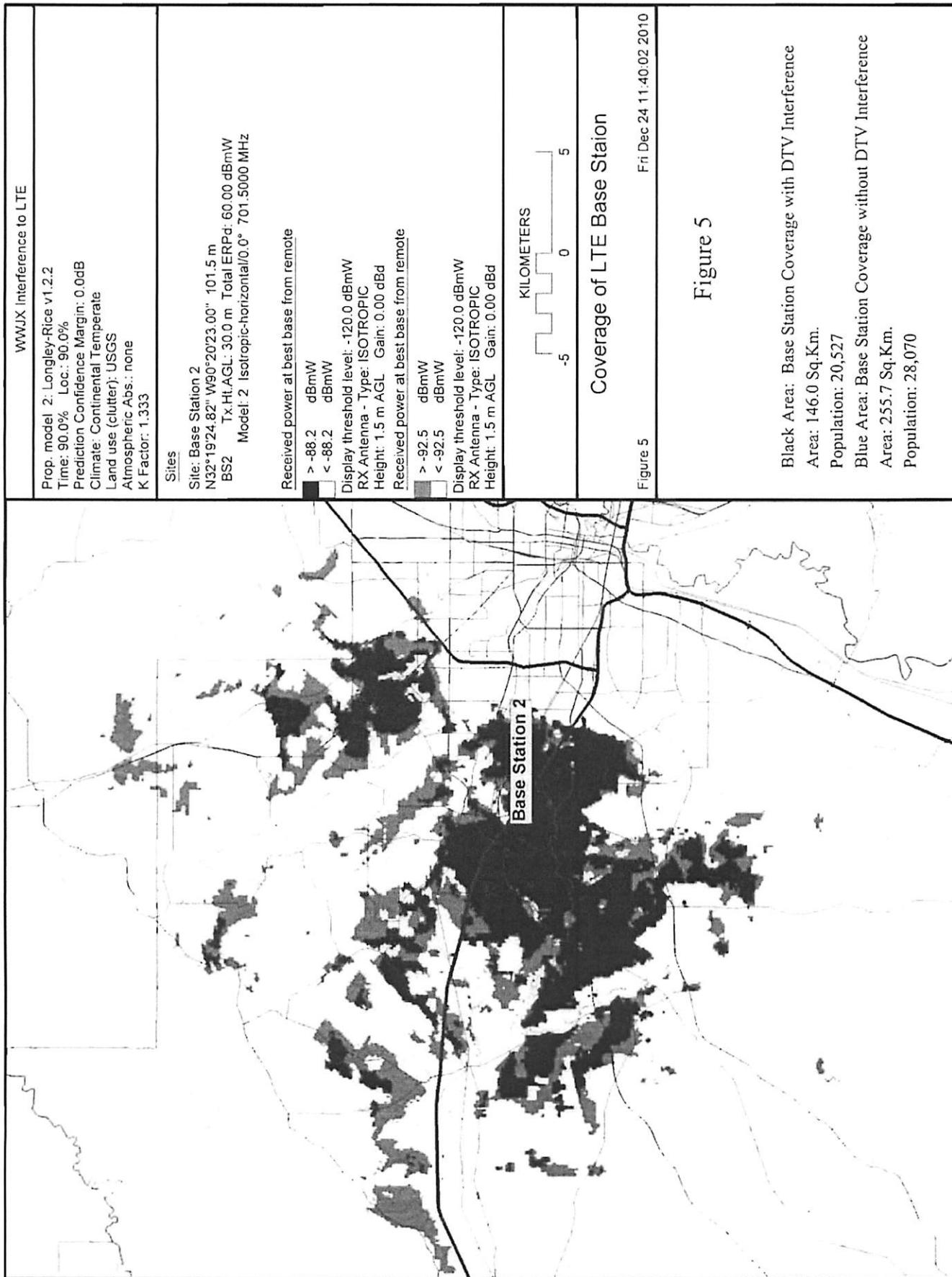


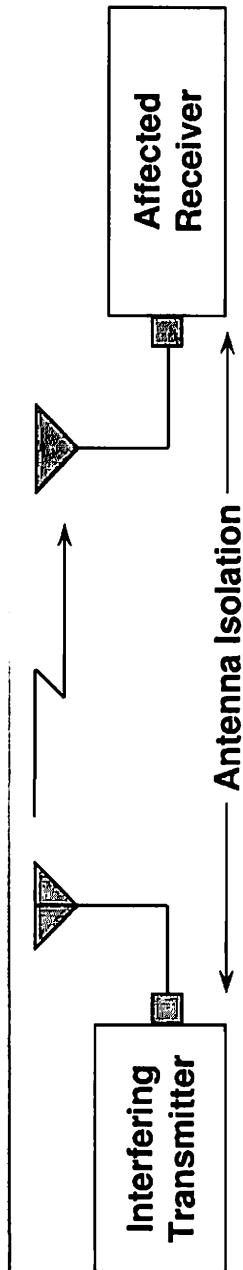
Figure 3





Appendix A

Criteria for Determining BS to BS Antenna Isolation



- Antenna isolation is defined as the path loss (including both antenna gains, cable losses and propagation loss through the air) from an interfering transmitter Equipment Antenna Connector (EAC) to an affected receiver EAC
- Antenna isolation requirements are derived based on the following criteria:

Criterion 1: The interfering BS transmitter out-of-band emissions received by the affected BS is 10 dB below the affected receiver noise floor

Criterion 2: The total interfering BS carrier power attenuated by the affected BS RF receive filter is 10 dB below the affected receiver 1 dB compression point

Criterion 3: The affected BS receiver 3rd order IIP caused by interfering BS carriers (attenuated by the affected BS RF receive filter) is 10 dB below the affected receiver noise floor

Criterion 4: The total interfering BS carrier power attenuated by affected BS receiver RF, IF and baseband filters is 10 dB below the affected receiver noise floor

- The external interference threshold (10 dB below the affected Rx noise floor) will cause a 0.4 dB Rx desensitization

If the cell layout is designed to the maximum cell range supported by the uplink budget and the propagation loss slope is 35 dB/decade, the 0.4 dB Rx desensitization could reduce the uplink cell coverage by 5%

Interference from DTV CH 51 Station to Lower A Block LTE BS: Antenna Isolation Calculation Based on Criterion 1

- It is suggested that acceptable in-band interference level at Alcatel-Lucent LTE RRH EAC be - 114.5 dBm/4.5 MHz (i.e., 10 dB below the noise floor of -104.5 dBm/4.5 MHz considering a 3 dB receiver noise figure)
- Assumption: DTV station ERP is 25 kW (i.e., 76 dBm EIRP)
 - Assuming a 11 dBi effective BS antenna gain (i.e., antenna gain minus cable loss), the DTV CH 51 station transmit power is 65 dBm referenced to the EAC
- Conservative assumption: According to FCC CFR Title 47 Part 73.622 (h)(1), DTV station out-of-block emissions measured in a 500 kHz band must be attenuated no less than $11.5x(\Delta f \text{ in MHz} + 3.6)$ dB at 0.5-6 MHz offsets from the block edge
 - When a 5-MHz LTE channel is at 699-704 MHz (uplink), TV station emission power falling into the effective LTE resource blocks (699.25-703.75 MHz) is 57.3 dB below the DTV carrier power
- The required isolation from the DTV CH 51 station to LTE BS is 122 dB [= 65 - 57.3 dBm - (-114.5 dBm)] to meet Criterion #1
- If the DTV station ERP increases from 25 kW to 1000 kW (i.e., FCC power limit for DTV), the antenna isolation based on Criterion 1 will increase from 122 dB to 138 dB

Interference from DTV CH 51 Station to Lower A Block LTE BS: Antenna Isolation Calculation Based on Criteria 2, 3 and 4

- Assumption for DTV station Tx power: 25 kW ERP → 65 dBm power at EAC
- **Criteria 2, 3 & 4:**
 - Alcatel-Lucent commercial Lower 700 MHz LTE RRH (equipped with 15.5 MHz Filter) shall maintain a 0.4 dB Rx desensitization in the presence of a -10 dBm DTV carrier power at EAC (i.e., a 6 dB Rx desensitization in the presence of +5 dBm DTV carrier power)
 - ALU RRH Rx blocking performance is 54 dB better than TS 36.104 Rx narrowband blocking standard (a blocking level of -49 dBm with a 6 dB Rx desensitization)
 - The antenna isolation required is 75 dB [= 65 dBm - (-10 dBm)]
- If the DTV station ERP increases from 25 kW to 1000 kW, the antenna isolation based on Criteria 2, 3 & 4 will increase from 75 dB to 91 dB

Summary

- The required antenna isolation from DTV CH 51 Station to Lower A Block LTE BS to meet all interference mitigation criteria is about 122 dB for 25 kW DTV ERP and 138 dB for 1000 kW DTV ERP (dictated by FCC out-of-band emissions for DTV CH 51 station)
 - Further improving LTE BS Rx filters does not improve antenna isolation requirement, unless DTV CH 51 station emission mask (with 1000 kW carrier ERP) is improved to be 47 dB below FCC emission limit
 - The 122 dB and 138 dB antenna isolation requirements could be difficult to meet by antenna engineering in the field alone
 - If the free space propagation with a slope of 20dB/35dB per decade can be applied between DTV station and Lower A Block BS, the antenna separation requirement for 1000 kW DTV ERP is about 6/3 times that for 25 kW DTV ERP
 - If the antenna isolation in the field meets the 122 dB requirement for 25 kW DTV ERP and the DTV station ERP increases from 25 kW to 1000 kW, then the LTE BS Rx desensitization increases from 0.4 dB to 7 dB (corresponding to a uplink cell coverage reduction of 60% for a 35 dB/decade propagation loss slope)
- The antenna isolation requirement are conservative due to consideration of FCC emission limit for DTV CH 51 station
 - The real isolation requirement could be less than the above requirement
 - It is suggested that DTV Channel 51 emission mask be obtained from DTV operators/vendors or measured in the field
 - If the actual DTV Channel 51 station carrier and out-of-band emission power are available, the antenna isolation requirement will be revised accordingly